WHAT IS CLAIMED IS:

1   1.   An apparatus, comprising:

2   a cross correlator operable to receive a first audio signal

3   and a second audio signal, the cross correlator also operable to

4   cross correlate the first and second audio signals to produce a

5   cross-correlated signal;

6   at least one parameter identifier operable to receive the

7   cross-correlated signal and identify a plurality of parameters

8   associated with at least one of the first and second audio signals;

9   and

10   a score generator operable to receive the plurality of

11   parameters and generate an indicator identifying an extent to which

12   the first and second audio signals match.

1   2.   The apparatus of Claim 1, wherein the at least one

2   parameter identifier comprises:

3   a delay identifier operable to identify a delay between the

4   first and second audio signals;

5   a correlation identifier operable to identify an amount of

6   correlation between the first and second audio signals; and

7   a pitch variation identifier operable to identify a variation

8   in pitch between the first and second audio signals.

1   3.   The apparatus of Claim 2, wherein:

2   the delay identifier is operable to identify the delay by

3   identifying a maximum value in the cross-correlated signal;

4   the correlation identifier is operable to identify the amount

5   of correlation by normalizing the cross-correlated signal; and

6   the pitch variation identifier is operable to identify the

7   variation in pitch by identifying a coincidental harmonic frequency

8   using the cross-correlated signal.

1   4.   The apparatus of Claim 2, wherein the score generator is

2   operable to generate the indicator by:

3   generating a first score using the delay between the first and

4   second audio signals and the amount of correlation between the

5   first and second audio signals;

6   generating a second score using the variation in pitch between

7   the first and second audio signals; and

8   combining the first and second scores to produce a final

9   score.

1   5.   The apparatus of Claim 1, wherein the first audio signal

2 is associated with an input signal and the second audio signal is

3 associated with a reference signal; and

4   further comprising:

5   a plurality of decimators operable to receive and

6 decimate the input signal and the reference signal; and

7   a plurality of filters operable to filter at least one of

8 the input signal, the reference signal, a decimated input signal,

9 and a decimated reference signal.

1   6.   The apparatus of Claim 5, wherein the plurality of

2 filters comprise:

3   a first anti-aliasing low pass filter operable to filter the

4 input signal, a first of the decimators operable to decimate the

5 filtered input signal;

6   a second anti-aliasing low pass filter operable to filter the

7 reference signal, a second of the decimators operable to decimate

8 the filtered reference signal;

9   a first band pass filter operable to filter the decimated

10 input signal to produce the first audio signal; and

11   a second band pass filter operable to filter the decimated

12 reference signal to produce the second audio signal.

1   7.   The apparatus of Claim 1, further comprising a voice

2   activity detector operable to detect a voice in the input signal;

3   wherein the score generator is operable to generate the

4   indicator after the voice activity detector detects the voice in

5   the input signal.

1   8.   The apparatus of Claim 1, wherein:

2   each of the first and second audio signals comprises a

3   plurality of frames; and

4   the cross correlator is operable to correlate one frame from

5   the first audio signal and multiple frames from the second audio

6   signal to produce the cross-correlated signal.

1   9.   The apparatus of Claim 8, wherein the indicator

2   identifies an extent to which the one frame from the first audio

3   signal matches at least a portion of the multiple frames from the

4   second audio signal.

1   10. A method, comprising:

2   receiving a first audio signal and a second audio signal;

3   cross-correlating the first and second audio signals to

4 produce a cross-correlated signal;

5   identifying a plurality of parameters associated with at least

6 one of the first and second audio signals using the cross-

7 correlated signal; and

8   generating an indicator identifying an extent to which the

9 first and second audio signals match using the plurality of

10 parameters.

1   11. The method of Claim 10, wherein the plurality of

2 parameters comprise:

3   a delay between the first and second audio signals;

4   an amount of correlation between the first and second audio

5 signals; and

6   a variation in pitch between the first and second audio

7 signals.

1   12.   The method of Claim 11, wherein identifying the plurality

2 of parameters comprises:

3   identifying the delay by identifying a maximum value in the

4 cross-correlated signal;

5   identifying the amount of correlation by normalizing the

6 cross-correlated signal; and

7   identifying the variation in pitch by identifying a

8 coincidental harmonic frequency using the cross-correlated signal.

1   13.   The method of Claim 11, wherein generating the indicator

2 comprises:

3   generating a first score using the delay between the first and

4 second audio signals and the amount of correlation between the

5 first and second audio signals;

6   generating a second score using the variation in pitch between

7 the first and second audio signals; and

8   combining the first and second scores to produce a final

9 score.

1   14.   The method of Claim 10, wherein the first audio signal is

2   associated with an input signal and the second audio signal is

3   associated with a reference signal; and

4   further comprising:

5   decimating the input signal and the reference signal; and

6   filtering at least one of the input signal, the reference

7   signal, a decimated input signal, and a decimated reference signal.

1   15.   The method of Claim 14, wherein filtering at least one of

2   the signals comprises:

3   anti-alias low pass filtering the input signal;

4   anti-alias low pass filtering the reference signal;

5   band pass filtering the decimated input signal to produce the

6   first audio signal; and

7   band pass filtering the decimated reference signal to produce

8   the second audio signal.

1   16.   The method of Claim 10, further comprising detecting a

2   voice in the input signal;

3   wherein generating the indicator comprises generating the

4   indicator after detecting the voice in the input signal.

1   17.   The method of Claim 10, wherein:

2   each of the first and second audio signals comprises a

3   plurality of frames; and

4   cross-correlating the first and second audio signals comprises

5   cross-correlating one frame from the first audio signal and

6   multiple frames from the second audio signal to produce the cross-

7   correlated signal.

1   18. A computer program operable to be executed by a

2 processor, the computer program comprising computer readable

3 program code for:

4   receiving a first audio signal and a second audio signal;

5   cross-correlating the first and second audio signals to

6 produce a cross-correlated signal;

7   identifying a plurality of parameters associated with at least

8 one of the first and second audio signals using the cross-

9 correlated signal; and

10   generating an indicator identifying an extent to which the

11 first and second audio signals match using the plurality of

12 parameters,

1   19. The computer program of Claim 18, wherein the plurality

2 of parameters comprise:

3   a delay between the first and second audio signals;

4   an amount of correlation between the first and second audio

5 signals; and

6   a variation in pitch between the first and second audio

7 signals.

1   20. The computer program of Claim 19, wherein the computer

2 readable program code for identifying the plurality of parameters

3 comprises computer readable program code for:

4   identifying the delay by identifying a maximum value in the

5 cross-correlated signal;

6   identifying the amount of correlation by normalizing the

7 cross-correlated signal; and

8   identifying the variation in pitch by identifying a

9 coincidental harmonic frequency using the cross-correlated signal.

1   21. The computer program of Claim 19, wherein the computer

2 readable program code for generating the indicator comprises

3 computer readable program code for:

4   generating a first score using the delay between the first and

5 second audio signals and the amount of correlation between the

6 first and second audio signals;

7   generating a second score using the variation in pitch between

8 the first and second audio signals; and

9   combining the first and second scores to produce a final

10 score.

1   22.   The computer program of Claim 18, wherein the first audio

2   signal is associated with an input signal and the second audio

3   signal is associated with a reference signal; and

4   further comprising computer readable program code for:

5   decimating the input signal and the reference signal; and

6   filtering at least one of the input signal, the reference

7   signal, a decimated input signal, and a decimated reference signal.

1   23.   The computer program of Claim 22, wherein the computer

2   readable program code for filtering at least one of the signals

3   comprises:

4   computer readable program code for anti-alias low pass

5   filtering the input signal;

6   computer readable program code for anti-alias low pass

7   filtering the reference signal;

8   computer readable program code for band pass filtering the

9   decimated input signal to produce the first audio signal; and

10   computer readable program code for band pass filtering the

11   decimated reference signal to produce the second audio signal.

1   24. The computer program of Claim 18, further comprising

2   computer readable program code for detecting a voice in the input

3   signal;

4   wherein the computer readable program code for generating the

5   indicator comprises computer readable program code for generating

6   the indicator after detecting the voice in the input signal.

1   25. The computer program of Claim 18, wherein:

2   each of the first and second audio signals comprises a

3   plurality of frames; and

4   the computer readable program code for cross-correlating the

5   first and second audio signals comprises computer readable program

6   code for cross-correlating one frame from the first audio signal

7   and multiple frames from the second audio signal to produce the

8   cross-correlated signal.